REMARKS

The courtesies extended to the undersigned by Examiner Yeh and by Supervisory Patent Examiner Chen during the interview held April 20, 2009 are acknowledged and appreciated. During the interview, the discussion was directed to the differences that exist between the subject invention, as recited in the currently pending claims, and the prior art cited and relied on. It was emphasized that the subject invention, as recited in currently pending independent claims 15 and 16, uses calculation specifications, in the form of first and second arithmetic rules, to generate output signals which represent red/green and blue/yellow receptive fields of color perception of a human eye. The printed image is thus compared with a reference image not from a pure pixel by pixel color comparison but instead by a pixel by pixel color comparison which is representative of a color comparison that would be done by a human eye. It is thus believed that the claims now pending in the subject application are patentable over the prior art cited and relied on, taken either singly or in combination. Reexamination and reconsideration of the application, and allowance of the claims is respectfully requested.

As is disclosed in the Substitute Specification, as is depicted in the accompanying sheets of drawings, and as recited in currently amended independent claims 15 and 16, the subject invention is directed to a method for analyzing color deviations of a printed image. The printed image, which is typically a multi-color image formed on a rapidly moving web of newspaper, is passed by at least one image sensor. That image sensor generates pixel by pixel image sensor signals for each of first, second and third color channels of the printed image. Those color channels are preferably red, green and blue color channels since those provide the possibility of using a widely distributed color model. Also, since the human eye is structured having areas that sense these three colors, the system is more adept at performing a comparison which is representative of the color perception of a human eye.

The printed image sensor provides a separate image sensor signal for each one of the three separate color channels, typically red, green and blue. The first and second color channel

signals are linked to each other using a first calculation specification consisting of a first arithmetic rule. This first output signal of a first resultant compensation color channel is representative of a red/green receptive field of color perception of a human eye.

The third color channel image sensor signal is linked to a combination of the first and second color channel image sensor signals by use of a second calculation specification consisting of at least a second arithmetic rule. A second output signal, which is of a second resultant compensation color channel, that is also representative of a blue/yellow receptive field of the color perception of a human eye is also now generated. The two calculation specifications are selected to form weighted differences between these representative color channel image sensor signals and corresponding to first and second color perceptions of a human eye.

Once the first and second calculation specifications have been used to form the weighted differences between the first, second and third color channel image sensor signals, they are compared to similar signals that have been provided for at least one reference image. A reference memory is used to store the reference image signals and to store the first, second and third output signals. A classification system is provided and is used to perform this comparison in the reference memory. The first and second compensation channel output signals of the printed image are compared with those of the reference image in the reference memory by using the classification system. Since the first and second output signals of the first and second compensation color channels represent receptive fields of color perception of the human eye, the acceptability of that human eye color perception of the printed image is determined in the reference memory using the classification system.

In the non-final Office Action of January 22, 2009 in the subject US patent application, claims 15-36 were rejected under 35 USC 101 as not falling into one of the four statutory categories of invention. Claims 15, 17, 19, 23 and 25 were rejected under 35 USC 103(a) as being unpatentable over newly cited US Patent No 5,999,636 to Juang in view of the previously

cited and discussed publication to Swain et al. Claim 21 was rejected under 35 USC 103(a) over Juang in view of Swain and further in view of US Patent No 5,268,753 to Yamaguchi. Claim 25 was rejected under 35 USC 103(a) as being unpatentable over Juang in view of Swain and further in view of US Patent No 6,486,981 to Shimura. Claims 27, 29 and 31 were rejected under 35 USC 103(a) over Juang in view of Swain and further in combination with US Patent No 6,950,554 to Shiratani. Claim 33 was rejected under 35 USC 103(a) as being unpatentable over Juang in view of US Patent No 6,751,348 to Buzoloiu. Claims 16, 18, 20, 24 and 36 were rejected under 35 USC 103(a) as being unpatentable over Juang in view of Swain and further in view of US Patent No 6,911,963 to Baba. The rest of the claims were rejected using the combination of Juang, Swain and Baba in combination with the several other secondary references as applied to the corresponding ones of the claims which depend from independent claim 15. Those grounds of rejection need not be repeated a second time.

Referring initially to US Patent No 5,999,636 to Juang, as was discussed with Examiner Yeh and with SPE Chen during the interview, this document discloses an apparatus and a process for inspecting print materials. It uses a CCD sensor, generally at 3, as seen in Fig. 1, to inspect a printing impression, as that printing impression passes by the CCD array sensor 3. The CCD sensor 3 may be a multi-channel array sensor. In use, it detects the printed image and converts it into a pixel-by-pixel, color-by-color separated ones of red, green and blue channels, as discussed at column 3, lines 58-60. Those digitalized pixels are compared, on an individual color basis, with similar pixels from a reference image. Flawed pixels are weighted according to their flaw severity and are accumulated by their specific type of flaw, all as discussed at column 3, lines 60-63. The result is the generation of flaw grade values. These flaw grade values are compared to the threshold values to determine if the specimen is acceptable or not.

As discussed at column 7, lines 30-34, each pixel is assigned a flaw severity code. A code of 0 is a pixel that is not flawed. Codes of 1-16 are used to indicate under inking types of

flaws. Codes 17-32 are used to determine over inking types of flaws. As the severity of the flaw increases, its flaw severity code also increases.

The Juang patent uses a purely mathematic approach to flaw detection. The pixels are compared, on a one-to-one basis with reference pixels. A flaw in each pixel is given a flaw value. When the sum of the flaw values reaches a threshold value, a determination of a defective product is made. There is no consideration given to the fact that the overall printed image may still be acceptable even though various ones of the pixels may individually have flaw codes sufficient to trigger an alarm. There is no effort in Juang to try to simulate or compare a printed image with a reference image on the basis of a human perception of that image. The Juang reference simply assigns flaw codes, counts the flaw codes and sounds an alarm or raises some other type of warning if a certain level of flaw codes is reached.

As was discussed with Examiner Yeh and SPE Chen, a printed color image, such as is typically seen in a printed newspaper, uses typically four printing couples, each of which prints one color. The various hues and shades that can be realized are formed by the placement of several inks either on top of each other or adjacent each other on a pixel by pixel basis. The human eye sees colors in its own unique fashion. That human color perception is not easily reproduced by the use of a CCD camera to scan a printed image and to simply break it down into red, blue and green pixels. The Juang reference performs such an analysis but it does not teach or suggest that the human eye will "see" an image in a color that may well be different from what is seen by a CCD sensor that merely divides the image into its separate color pixels.

The secondary reference to Swain was cited in the rejection of claims 15 and 16 as being in the same field as Juang, which was recited as "color indexing". As will be discussed below, that assertion is believed to be incorrect. Swain was asserted as providing a first calculation specification and a second color specification, with the Examiner relying on page 16 at the top left. As will also be discussed below, that assertion is also believed to be incorrect.

In Swain, there is disclosed a process for using a color histogram to either identify an unknown object which is situated at a known location or to determine the location of a known object. In the Swain example, these objects could be, for example, boxes of cereal. In other words, the first object is to locate a known box of cereal which may be placed in one of a variety of possible locations in a space. The second object is to identify an unknown object whose location is known.

These objects are accomplished by providing a computer database with a plurality of color histograms for all of the possible objects to either be located or identified. A histogram is a frequency distribution graph that consists of rectangles that correspond to color hues and to the frequency of the occurrence of each such color hue in a known object. Various histograms are depicted at pages 29 and 30 of the reference. As may be seen at page 29, the histogram depicted there is a quantification of the color pattern, by color locations and intensities, of a box of Crunchberries cereal. Each color histogram is essentially a color fingerprint of its respective object. If the computer has the color histogram of an object in its database, it can either find the discussed object in an area field of different objects, or it can identify an object whose location is known but whose specific identity is not known. This is done by providing a histogram of the known object and by comparing that histogram with that of the object which is to be identified. If the location of a known object is to be determined, the computer will compare newly created histograms of each object it locates. When the newly created histogram matches the histogram of the known object, its location has been ascertained.

The Swain article has nothing to do with print quality identification and certainly has nothing to do with print quality identification or comparison using human visual characteristics. In Swain, it is not relevant how well the cereal box has been printed. What is important is that all the cereal boxes are similar enough in their printing so that their histograms will serve as an identifier of them. Swain is not directed to any consideration of the quality of the printing. He is interested only in the comparison of histograms.

It was asserted by Examiner Yeh in the Office Action of January 22, 2009 that Swain discloses calculation specifications by referring to the several expressions set forth at the top of page 13 of the publication. As was discussed during the interview, and as is noted in Swain itself, these are expressions of the three opponent color axes which are used to define human color perception. Opponent color theory suggests that the cones in the human eye see three opponent channels of color. The first of these is red versus green axis or "rg = r – g". The second of these is blue versus yellow axis or "by = 2 * b – r – g". In this expression, there is acknowledged the human eye's structure as having more of the red and blue detectors than there are green detectors. The third expression at the top of page 13 of the Swain article is the white/black axis or "wb = r + g + b". If all three of the color axes red, green and blue are present, the result is the color black. If none are present, the result is the color white.

The discussion at pages 6 and 7 of the Office Action, with respect to the interpretation of the Swain article is not supported by any teaching of the Swain article. As discussed above, the three expressions at the top of the left column of page 13 of the Swain article are not calculation specifications, consisting of at least a first or a second mathematical rule and usable for linking a red and green color channel printed image signal sensor or linking a blue color channel image sensor signal with a combination of red and green signals to generate output signals that represent receptive fields of color perception of a human eye.

It would not be appropriate to combine the teachings of Juang and Swain to render either of claims 15 or 16 obvious to one of skill in the art. Juang is concerned with the detection of color flaws on individual pixels and the summation of those flaws to determine if a printed image has an error. Juang does not consider or discuss anything having to do with human perception of color. Juang senses and quantifies separate color flaws for each color pixel. It does not attempt to indicate how those separate color pixels may have interaction with each other to form an image which is perceived by a human using a human receptive field or fields of color perception.

Swain is concerned solely with forming a computer recognizable fingerprint of a particular colored object by quantifying that object's colors, in terms of frequency and location. If the cereal box has a red upper left corner and a blue lower right corner, it will have a unique histogram. That unique histogram can be used to identify the object. It cannot be used to determine the quality of the printing that is used to impart the colors to the boxes. The teachings of the Swain reference are not combinable with the teachings of the Juang reference. The use of the term "color" in both is not sufficient. Even if the references were to be combined in some fashion, the result would not be a method for analyzing color deviations of a printed image that includes compensating for the difference between a human visual perception of a printed image and a fragmented color by color pixel flaw detection as taught by Juang.

With respect to the rejection of claim 16, the third reference to Baba, US Patent No 6,911,963 does not provide the teachings which are missing from the combination of Juang and Swain. Baba is directed to a field sequential color display method. As discussed at column 1, lines 40-45, the subject field-sequentially additive color mixing system is used by temporarily dividing each input picture into its three primary color display periods and to display each of these divided periods in its individual displays sequentially. The three red, green and blue images of an input picture are displayed sequentially and at such a rapid speed that the viewer does not recognize the divided periods. The purpose of this field-sequential color display is to provide a method which is capable of reducing color breakup of an optical image. The discussion at page 19 and at the top of page 20 of the Office Action does not appear to be relevant to the subject invention, as recited in currently amended claim 16.

All of the rest of the claims which are currently pending in the subject application depend either directly from one or the other of believed allowable, currently amended claims 15 or 16. The several references cited to allegedly show individual features of these dependent claims do not provide the teachings missing from the Juang, Swain and Baba references. No further discussion of those secondary references is believed to be necessary.

Turning now to the rejection of the claims under 35 USC 101, both of claims 15 and 16 have been amended. It is believed, as discussed with Examiner Yeh and with SPE Chen that these claims now comply with the statutory requirements of 35 USC 101. Both of the claims have been amended to recite the provision of at least one reference image. The reference image output signals of first and second reference image compensation channels are stored in a reference memory. There is also provided a classification system which is usable to compare the first and second reference image output signals with the first and second printed image output signals in the reference memory. The result is a classification of the first and second output signals so that an acceptability of those output signals can be determined. It is believed that claims 15 and 16, as currently amended recite a series of steps that are positively tied to another statutory category that accomplishes the claimed method steps. It is to be noted that the recitation of the use of a classification system for comparing the printed image output signals with the reference image output signals was recited in claims 29 and 30. Since that language has been incorporated into believed allowable claims 15 and 16 as currently amended, those claims have been cancelled.

SUMMARY

Independent claims 15 and 16, as currently amended, are believed to be patentable over the prior art cited and relied on, as are the various claims which depend from them. These claims are also believed to be in compliance with 35 USC 101 for the reasons set forth above.

As discussed with Examiner Yeh and SPE Chen, this Third Amendment is believed to overcome the rejections based on the newly located Juang reference, as well as the previously cited references. Should either Examiner Yeh or SPE Chen believe that further discussions of these claims would be beneficial, they are requested to call the undersigned.

Allowance of the claims, and passage of the application to issue is respectfully requested.

Respectfully submitted,

Volker LOHWEG
Harald Heinrich WILLEKE
Applicants

JONES, TULLAR & COOPER, P.C.
Attorneys for Applicant

Douglas R. Hanscom
Reg. No. 26,600

April 22, 2009
Customer No. 23294
JONES, TULLAR & COOPER, P.C.
P.O. Box 2266 Eads Station
Arlington, Virginia 22202
Phone: (703) 415-1500
Fax: (703) 415-1508
E-mail: mail@jonestullarcooper.com
Attorney Docket: W1.1914 PCT-US